Does HBA1C Correlate with Lipid Profile in Type 2 Diabetes Mellitus? A New Evidence from Medan, North Sumatera

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ABSTRACT

Background: Diabetes mellitus (type 2 DM) is now ranked first in health problems and its prevalence tends to increase worldwide. The Diabetes Control and Complication Trial (DCCT) study showed that lowering HbA1c rates may delay or prevent chronic complications. One of the risk factors for CHD in type 2 DM is dyslipidemia, i.e lipid metabolism disorders in the form of elevated total cholesterol, triglyceride (TG), low-density lipoprotein (LDL), and decreased levels of high-density lipoprotein (HDL). This study aimed to determine the correlation between HBA1C and blood sugar, as well as lipid profile in patients with type 2 DM.
Subject and Methods: This was an analytic observational study with a cross-sectional design. The study was conducted at the Endocrinology and Metabolic polyclinic Pirngadi Hospital, Medan, North Sumatera, from January to February 2018. A total sample of 10 patients diagnosed as type 2 diabetes mellitus with obesity was selected for this study. The independent variables were blood sugar, lipid profile including total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), and triglyceride. The dependent variable was HbA1c level. Lipid profile was measured by blood serum examination. HbA1c level was measured by blood serum examination. The data were analyzed by Pearson correlation.
Results: Hba1c was positively correlated with blood sugar levels and was statistically significant (r= 0.81; p= 0.005). HbA1c correlated weakly and was statistically non-significant with total cholesterol (r= 0.14, p= 0.702), LDL (r= 0.15; p= 0.683), HDL (r= 0.04; p= 0.922), and triglycerides (r= 0.06; p= 0.860).
Conclusion: HbA1c correlates with blood sugar levels but does not show correlation with lipid profiles.

Keywords: HBA1C, lipid profile,blood sugar, type 2 diabetes mellitus

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BACKGROUND

Diabetes Mellitus Type 2 (DMT2) is a heterogeneous metabolic disorder characterized by hyperglycemia that occurs due to insulin secretion abnormalities, insulin work or both and both genetically and clinically with symptoms of a lack of carbohydrate tolerance. The World Health Organization (WHO) has previously formulated that DM is something that cannot be answered and discussed in a clear and concise manner but can generally be stated to be a collection of anatomical and chemical problems resulting from a number of factors in which there is an absolute or relative insulin deficiency and function impairment insulin (Price, 2006, ADA, 2014).

DM has now ranked first in health issues. The main findings of diabetes studies by the Diabetes Control and Complication Trial (DCCT) have demonstrated the importance of HbA1c testing. Studies show that lowering HbA1c rates may delay or prevent chronic complications (Sultan-

pur et al., 2010; Kumar and Singh, 2011; Loei et al., 2013).

The prevalence of DMT2 disease increases along with the increase of BMI (body mass index) due to increased adipose tissue characterized by decreased HDL and increased triglycerides (Koampa, et al, 2016). High BMI has a 2-fold greater risk of developing DMT2 compared to low BMI (Susilowati, 2015).

HbA1c examination should be considered as monitoring for diabetes screening and diagnosis. The benefits of HbA1c are to assess the quality of index control or long-term glycemic levels and assess the effecttiveness of therapy, but recent studies support the wider use of HbA1c, not only for monitoring but also useful for diagnosing or screening for type 2 DM (Soulimane et al., 2011, PERKENI, 2015; Muraliswaran et al., 2016).

One of the risk factors for CHD in type 2 diabetes is dyslipidemia, ie lipid metabolism disorders in the form of elevated total cholesterol, triglyceride (TG), low density lipoprotein (LDL), and decreased levels of high density lipoprotein (HDL). The description of dyslipidemia in type 2 DM most frequently found is an increase in TG levels and the decreaseof HDL levels. Although LDL levels do not always increase, LDL particles will undergo adjustment of modifications into small and densely atherogenic forms (Adam, 2004; Karel, 2006; Hendromartono, 2006 and Noviyanti et al., 2011; Adam, 2014).

HbA1c examination is used routinely for long-term glycemic control and can be used as a marker of lipid profile levels. Because of high HbA1c levels, LDL cholesterol is also high, leading to an increased cardiovascular risk (Muraliswaran et al., 2016).

Based on previous studies, it was found that hyperglycemic conditions have direct and indirect effects. The indirect effects of hyperglycemic conditions are estimated by their effect on lipid profiles. Considering this fact, a study entitled the correlation between HbA1c and lipid profile in patients with type 2 diabetes mellitus was conducted.

SUBJECTS AND METHOD

The study was conducted using observational analytic with cross sectional study approach. In this study, there was no follow-up action on the measurements done. It was conducted on a set of objects, in a certain period of time which aims to determine the relationship of HbA1c levels with lipid profile in patients with type 2 diabetes. Ten obese patients with type 2 diabetes who seek treatment at Endocrine and Metabolic PolyclinicsPirngadihospital Medan from January to February 2018 were recruited as the samples.

Inclusion Criteria

a) Men/Women> 18 years old who suffer from type 2 DM.
b) Patients are willing to give written permission after given informed consent to participate in this study.
c) Patients who do not take anti-cholesterol drugs for 1 month
d) Patients with BMI> 27 (obesity I and obesity II)

Exclusion Criteria

a) The patients are severely ill or are not allowed to participate in this research.
b) The patients are not cooperative.
c) Patients suffering from chronic diseases.

The variables studied in this research are:

1. The independent variable is HbA1c level
2. The dependent variable is the lipid profile (Total Cholesterol, HDL, LDL and Triglycerides).

In this study, patients' lipid profile data obtained from the report of laboratory results attached and the way of measure-

ment by looking at the data lipid profile of laboratory examination results are in units of mg / dl. HbA1c levels in type 2 diabetes mellitus are according to PERKENI 2015 with unit percent (%).

The data were analyzed using statistical calculation to perform hypothesis test by Pearson correlation test method. If the normality test shows that the data are not normally distributed then the hypothesis test can be done using Spearman correlation test method.

RESULTS

Of the 10 diabetes patients outpatient in the Internal Medicine Section at Endocrine and Metabolic Polyclinics hospital, there was characteristics found and presented in Table 1.

Table 1.The Characteristics of Subjects

Characteristics	Mean ± SD
Age (years)	57.9±11.98
Weight (kg)* (Median,Min,Max)	73.5 (70.106)
Height (cm)	152.00±6.91
Cholesterol total	220.4±46.21
HDL	54.2±12.53
LDL	130.3±32.22
Trigliserida	179.40±82.58
HbA1c	9.8±2.45
Sistole	137±13.37
Diastole	86±9.66

*not normally distributed
Md: Median, Min: minimum, Max: maximum

Based on the results of the correlative test, it was found a positive correlation between HbA1c with total cholesterol, HDL, LDL and blood triglycerides (r = 0.139; r = 0.036; r= 0.148; r= 0.064) but it was not significant. This means that the worse HbA1c levels, the better the increase in lipid profile. This can be explained by the pathogenesis of type 2 DM during the advanced phase in which in this phase, excess glucose in the blood is stored in the form of fat. From the data obtained, there was a significant correlation between HbA1c and the blood sugar level (p= 0.005). (Table 2).

Table 2. The Correlation Between HbA1c and Lipid Profile

Variable	r	p
Total Cholesterol	0.139	0.702
HDL	0.036	0.922
LDL	0.148	0.683
Triglycerides	0.064	0.680
Glucose	0.808	0.005

On Table 3,the average level of HbA1c from the pre-hypertension group was 11.06, stage 1 hypertension with HbA1c= 9.42 and stage 1 hypertension with HbA1c= 8.85.

Table 3. The Average of HbA1c Level Based on Hypertension Descriptions

Group	Hba1c Mean±SD
Pre-hypertension	11.06±1.5
Stage 1 Hypertension	9.42±2.96
Stage 2 Hypertension	8.85±2.6

DISCUSSIONS

In this study, there were 10 samples who fulfilled the inclusion and exclusion criteria. The sample consisted of 1 man (10%) and 9 women (90%).A study by Yang (2010) also showed similar result. It was stated that most DM patients were female.

The average of HbA1c pateients was 9.8%. The average of total cholesterol level was 220.4 gr/dl, the level of HDL was 54.2 gr/dl, the level of LDL was 130.3 gr/dl, the average of triglycerides was 179.4 gr/dl and the average of HBA1c level was 9.8 % (Table 1).

One-way correlative test was implemented to determine the relationship between HbA1c with lipid profile in patients with type 2 diabetes mellitus with obesity. The results of correlative analytic test between glycemic control, lipid profile can be seen in table 2. The results showed that there was a positive correlation between HbA1c and total cholesterol levels (r= 0.14; p= 0.702). This was similar to previous study done by Singh and Kumar (2011), this study showed that there was no significant relationship between HbA1clevel and total cholesterol level. However, there was a positive relationship between them. There was a positive correlation between LDL level (r= 0.148; p= 0.683), HDL level (r= 0.036; p= 0.922) and Triglycerides level (r= 0.064; p= 0.860) but it was statistically non significant.

In this study, there was a significant correlation of HbA1c with blood sugar level (p=0,005).This implied that poor control of glucose metabolism was characterized by elevated blood sugar levels/ hyperglycemia. Poor HbA1c levels reflecting poor patient adherence to diabetic therapy. Diabetic therapy is a therapy given to DM patients to assess the benefits of treatment and as a handbook of dietary adjustment, physical exercise, and medication to achieve normal blood glucose levels, and avoid hyperglycemia or hypoglycemia. The effectiveness of diabetic therapy depend on the results of HbA1c test (Kilpatrick, 2008; Charitha, 2013; Lindarto, 2014).

According to Soesilowati (2012), stated that in normal people, a small fraction of hemoglobin would experience glycosylation. This mean that glucose was bound to hemoglobin through non-enzymatic processes and it was reversible. In DM patients, glycosylation of hemoglobin increased proportionately with blood glucose levels during the previous 2-3 months. If the blood glucose level was in the normal range between 70 -140 mg% for the last 2 - 3 months, then HbA1c test result would show a normal score. Due to slow replacement of hemoglobin, high HbA1c scores suggest that blood glucose levels were enhance for 4-8 weeks (Schteingart and David, 2013; Singh at al., 2014).

In the previous study according to the European Association for the Study of Diabetes (EASD) and International Diabetes Federation (IDF) in Paputungan and Sanusi (2014); which involved 600 participants in 11 countries through 24-hour glucose monitoring and HbA1c measurements showed a close relationship between blood glucose and HbA1c.

HbA1c was currently used as a glycemic indicator because it reflected glucose concentration in 1-2 months before test and was not influenced by diet before blood sampling. HBA1c was a monitoring tool in the management of patients with DM (Stopler and William, 2016).

This study also showed that the lower the HbA1c level, the lower the blood pressure. This determination can be caused by differences in standardization of hypertension control used. Because this research was a cross sectional study, the relationship obtained was only an estimate of relative

risk. The causal relationships between variables still cannot be determined. Because the data collection was done without paying attention to the variables that appear first.

The weakness in this study was a cross sectional study with limitations: 1. Not all confounding variables can be well controlled, therefore, further research was needed with appropriate research design. 2. This study was based on local state hospitals, therefore, to globally generalize a diabetes mellitus type 2 population with obesity should be wiser. 3. The number of samples was limited, therefore, more samples are needed.

It suggested further study with more varied samples is needed in order to prove the association between HbA1c and lipid profiles in patients with type 2 diabetes with obesity.

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